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Mobius Institute Precision Shaft Alignment Training: Introduction

Quick facts

If you need a refresher course, or you want to know what shaft alignment is all about, then this one-day course is ideal. With a walk through alignment benefits and methods, combined with hands-on exercises, your understanding and appreciation of shaft alignment will skyrocket.



Description:

Machines that have been precision aligned run longer, and cost less to run. Misalignment greatly reduces the life of bearings, seals, shafts and couplings. This course will provide an overview of the benefits of alignment, soft foot correction, dial-indicator and laser alignment methods, and how to move the machine.

Language:

Training delivered in Arabic and/or English based on the participants preference.

Training material is in English.

Who should attend?

If you have to align machines, and you already have some experience with shaft alignment, then this course will prove to be an excellent refresher.

On the other hand, if you want to know more about shaft alignment, its benefits, and the dial indicator and laser alignment procedures, then this course will give you a very good introduction.

What is unique about this course?

Mobius makes it unique. We use 3D animations and software simulators that completely demystify and demonstrate the alignment process – you need to see them to believe them! You will completely understand the readings and the three-dimensional alignment process. If you have previously performed shaft alignment, you will find that all of those steps and instructions will suddenly make a whole lot of sense – you will find yourself saying ‘Ah, now I understand” (and “I wish I took this course years ago”).

Topics:

Introduction to Shaft Alignment

Introduction

- *Why is misalignment so important?*
- *Bearing damage*
- *Seal damage*
- *Coupling damage*
- *Vibration*
- *Energy consumption*
- *Product quality*
- *Downtime and production capacity*
- *Detecting misalignment*

What is misalignment?

- *What is misalignment?*
- *A closer look at misalignment*
- *Shaft fatigue*
- *Even bent shafts have rotational centerlines*
- *Offset and angular misalignment*
- *Alignment conventions*
- *Specifying misalignment*
- *Using feet corrections to specify misalignment*
- *Using Total Indicator Readings to specify the misalignment*
- *Using offset and angularity to specify alignment targets*
- *Angularity targets*
- *Visualizing tolerance*
- *Tolerances and speed*
- *Spacer couplings (jack shafts) conventions and tolerances*
- *Published tolerances*
- *Dynamic movement*

- *Pre-Alignment checks and soft foot*
- *Pre-alignment tasks Determining the alignment state*

Determining the alignment state

- *Using a straightedge or feeler gauge*
- *Using dial indicators*
- *The Rim and Face method*
- *The Reverse Dial method*
- *Reverse dial method*
- *Dial indicator limitations*

Laser alignment systems

- *Laser alignment systems*
- *Moving the machine*
- *Moving the machine vertically - shimming*
- *Moving the machine laterally*
- *Summary*

In addition to viewing the 3D animations and using the alignment simulator software, time will be spent hands-on performing shaft alignment jobs

Mobius Institute Precision Shaft Alignment Training: Master Class

Quick facts

When hands-on training is combined with the famous Mobius Institute 3D animations and simulations, you know that you will enjoy a course that will leave you ready to take on any alignment challenge. You will develop an intuitive feel for the alignment system because you understand the fundamentals and you have had a chance to practice and ask questions.



Course description

Duration: 2-3 days (depends upon the amount of hands-on time)

Description:

Machines that have been precision aligned run longer, and cost less to run. Alignment greatly reduces the life of bearings, seals, shafts and couplings.

This course will equip you with the knowledge and skills so that you can use a dial indicator tool or laser alignment system to precisely align two components together. You will learn how to recognize misalignment and successfully set up the alignment job.

After reviewing the important reasons for performing shaft alignment, we will discuss the pre-alignment checks and corrections, including how to identify and correct soft foot.

Next we will discuss the operation of dial indicators, and cover the rim-face method and reverse-dial method. Not only will we explain and demonstrate the process, we will teach you how the calculations must be performed.

Next we explain the laser alignment systems; the benefits, basic theory of operation, and tips and techniques for successful use.

And finally we discuss how to move the machine and deal with all the problems that you are bound to encounter at some stage. We will also review how to deal with thermal growth, and how to approach a larger machine train.

Language:

Training delivered in Arabic and/or English based on the participants preference.

Training material is in English.

Who should attend?

If you have to align machines, then you need this course. If you own a modern laser alignment system you have two choices: you can just set up the lasers, enter the dimensions, take the readings and do what the equipment tells you to do, or you can understand what you are doing and be prepared when things go wrong – and they will. We will ensure you understand the entire process, and give you the skills to return to the plant and perform precision alignment. Note:

Although we will not have time to explain the operation of every model of laser alignment system, we will provide you with the knowledge so that you will be successful with whatever model you own.

What is unique about this course?

Mobius makes it unique. We use 3D animations and software simulators that completely demystify and demonstrate the alignment process – you need to see them to believe them! You will completely understand the readings and the three-dimensional alignment process. If you have previously performed shaft alignment, you will find that all of those steps and instructions will suddenly make a whole lot of sense – you will find yourself saying ‘Ah, now I understand’ (and “I wish I took this course years ago”).

Topics:

An Introduction to Shaft Alignment

*The benefits of shaft alignment
A quick overview of the alignment process*

Shaft Alignment Mathematics - A Primer

Offset, angularity and alignment mathematics

- *Introduction*
- *Equal triangles*
- *Triangles and alignment*
- *A triangle from two offsets*
- *Dealing with negative numbers*

Understanding Dial Indicators

Dial indicators

- *Introduction*
- *What can go wrong?*
- *Zero the dial*
- *Bar sag*
- *Total Indicator Readings (TIR)*
- *Hysteresis*
- *Clock positions*
- *Backlash*
- *Why do we rotate both shafts?*

Using dial indicators for shaft alignment

- *Using dial indicators for shaft alignment*
- *Rim measurements*
- *Face measurements*
- *Axial end-play and float*
- *Repeat all tests*
- *Validity rule*

Pre-Alignment Checks and Corrections

Pre-alignment Checks

- *Introduction*
- *Plan and review maintenance history*
- *Why is the machine not aligned?*
- *Installing a new machine*
- *Decide on the required tolerance and coupling gap*
- *Pipe strain*
- *Mechanical looseness*
- *Bent shafts and coupling runout*
- *General preparations on site: Safety*
- *General preparations on site: Clean up*
- *General preparations on site: Shims*
- *General preparations on site: Jacking bolts*

Soft Foot Checks and Corrections

Detecting and Correcting Soft Foot

- *Introduction*
- *Different types of soft foot*
- *Rocking soft foot*
- *Short foot - parallel air gap*
- *Even foot*
- *High foot*
- *Bent foot*
- *Squishy foot*
- *Induced soft foot*

Why is soft foot important?

- *Why is soft foot important?*
- *Shaft fatigue*
- *Bearing distortion*
- *Impact on the alignment task*

Testing for soft foot

- *Testing for soft foot*
- *Taking soft foot measurements*
- *Recording results*
- *Using dial indicators to measure soft foot*

Correcting soft foot

- *Correcting rocking soft foot*
- *Short cut number one: The Casanova method*
- *Short cut number two: The 80% Rule*
- *Using feeler gauges*
- *Using a "stair" of shims*
- *More complex shim patterns*
- *Detecting and correcting induced soft foot*
- *Mysterious soft foot*
- *Summary*

The Rim-Face Dial Indicator method

The Rim-Face dial indicator method

- *Introduction*
- *What if only one shaft can be rotated?*
- *Accuracy issues*
- *Setup problems*
- *Axial end-float*
- *Rim-Face Measurement Procedure*
- *Compensate for bar sag*
- *Alternative method*
- *Determine the alignment corrections*
- *Performing the calculations*
- *Computing the offset*
- *Computing the angularity*
- *Computing feet movements*
- *Shim calculations*
- *Move calculations*
- *Example calculations*
- *The graphical method*
- *Summary*

The Reverse-Dial Method

The Reverse Dial method

- *Introduction*
- *Reverse dial procedure*
- *Compensate for bar sag*
- *Performing the calculations*
- *Computing the offset*
- *Computing the angularity*
- *Computing feet movements*
- *Shim and move calculations*
- *An example*
- *Example:*
- *The graphical method*
- *Summary*
- *Alternative method*

Laser Alignment

Laser alignment systems

- *Introduction*
- *The basic components in a laser alignment system*
- *Benefits of laser alignment systems over dial indicators*
- *How do laser alignment systems work?*
- *Using a Prism - Return Beam Method*
- *Beam Splitter - Single Beam Method*
- *Twin Emitter/Detector Pairs - Dual Beam Method*
- *Using a horizontal beam and a vertical detector*

Using the laser alignment system

- *Performing the laser alignment*
- *Pre-alignment*
- *Preparing the coupling*
- *Attaching the brackets*
- *Attach the brackets*
- *Check the optics*
- *Mount the laser heads*
- *Aim the heads*
- *Zeroing the beam*
- *Check for repeatability*
- *Rough alignment ("roughing-in")*
- *Correcting gross angularity*
- *Correcting gross parallel offset*
- *Dealing with gross misalignment*
- *Rough alignment with a laser system*
- *Dealing with distance and angularity*
- *Cones and circles and distance*
- *Enter the machine dimensions*
- *How accurate should the dimensions be?*
- *Entering the coupling diameter*

Performing laser alignment measurements

- *Performing the measurements*
- *The 3:00-12:00-9:00 method*
- *Swept measurements*
- *Getting the results*
- *Aligning spacer shafts or jackshafts*
- *What if you can't rotate one shaft?*
- *What if the shaft can't be rotated easily?*
- *What if you can't rotate either shaft?*
- *Limitations of laser systems*
- *Backlash*
- *Vibration*
- *Heat, steam, sunlight, water vapor*
- *General comment about commercial systems*

Moving the Machine

Moving the machine

- *Introduction*
- *Perform the vertical move first*
- *Gross misalignment*
- *Using a laser alignment system*
- *Moving the machine vertically - shimming*

Base bound and bolt bound

- *Base bound*
- *Machine the feet*
- *Moving the machine horizontally*
- *Using a dial indicator to measure the horizontal move*
- *Using shims to measure horizontal machine moves*
- *Bolt bound*
- *Turn-down the bolts*
- *Open the bolt holes of the machine feet*
- *Moving the stationary machine*
- *Drill new holes*

Dynamic and Thermal Movement

Dynamic and Thermal Movement

- *Introduction*
- *Which machines will be affected?*
- *Thermal effects*
- *Manufacturer's supplied offsets*
- *Sources of heat*
- *Internal or system sources of heat*
- *External sources of heat*
- *Mechanical effects*
- *Pipe strain*
- *Oil wedges*
- *Jacking fluid*
- *Catenary sag*
- *Foundation changes*

Dealing with dynamic movements

- *Dealing with dynamic movements*
- *Temperature compensation*
- *Take 'hot' readings*
- *Monitoring the movement of the shaft or bearings*
- *Using laser heads to measure relative movement*
- *Issues to consider*
- *General issues to consider*
- *What do you do with the offset data?*
- *Manufacturer's offset data*
- *Determining targets graphically*
- *Summary*

Machine Train Alignment

Machine Train Alignment

- *Introduction*
- *Repeat your measurements*
- *Plan ahead*
- *Graphical method*
- *Optimizing the alignment*
- *Movement limitations*
- *Move in the vertical direction first*
- *Summary*

V-Belt and chain alignment

V-Belt and chain alignment

- *Introduction*
- *Secondary damages of misalignment*
- *Vertical angle misalignment*
- *Horizontal angle misalignment*
- *Parallel misalignment*
- *Procedure for correction*
- *Summary*

In addition to viewing the 3D animations and using the alignment simulator software, time will be spent hands-on performing shaft alignment jobs using our APP-AL-DEMO in the conference room, thus giving the opportunity for every attendee to practice alignment under the supervision of the trainer.